

What We Claim Is:

1 1. A method for estimating channel characteristics in a multicarrier transmission
2 system comprising the steps of:

3 receiving a multicarrier signal;
4 applying Fast Fourier transformations to carriers of said multicarrier signal;
5 estimating channel characteristics of a multicarrier channel over which said
6 multicarrier signal was transmitted using iterative processing; and
7 decoding said transformed multicarrier signal.

1 2. The method according to claim 1, wherein said iterative processing further
2 comprises the steps of:

3 determining if a block in a frame in the received signal is a training block;
4 tentatively decoding said block of said received signal;
5 calculating a tentative reference signal based on a previous training block;
6 generating a tentative estimation of channel characteristics using said tentative
7 reference signal;
8 decoding said block of said received signal;
9 calculating a reference signal based on said received block;
10 generating an estimation of channel characteristics using said reference signal;
11 incrementing the block number;
12 determining if the end of said frame has been reached;

accepting a next block of received signal if said end of said frame has not been reached; and
iteratively performing the steps above.

3. The method according to claim 2, wherein said decoding steps are performed using $\hat{\mathbf{c}}_n = \arg \min_{\mathbf{c}_n} \sum_m \|\mathbf{x}_{m,n} - \hat{\mathbf{H}}_{m,n} \mathbf{c}_n\|^2$.

4. The method according to claim 2, wherein said calculating steps are performed using $\tilde{\mathbf{H}}_{m,n} = \arg \min_{\mathbf{H}_{m,n}} \sum_m \|\mathbf{x}_{m,n} - \mathbf{H}_{m,n} \hat{\mathbf{c}}_n\|^2$.

5. The method according to claim 2, wherein said first generating step is performed using $\sum_{l=1}^{M_L} \mathbf{B}_l \mathbf{d}(\tilde{\mathbf{H}}_{m,n+1-l}) - \mathbf{d}(\hat{\mathbf{H}}_{m,n}) = 0$

6. The method according to claim 2, wherein said second generating step is performed using $\sum_{l=1}^{M_L} \mathbf{B}_l \mathbf{d}(\tilde{\mathbf{H}}_{m,n+1-l}) - \mathbf{d}(\hat{\mathbf{H}}_{m,n+1}) = 0$.

7. The method according to claim 1, wherein said decoding step further comprises the steps of:
demodulating said multicarrier received signal;
combining said demodulated multicarrier signal using a maximum ratio combiner; and
Viterbi decoding said combined signal.

1 8. The method according to claim 7, further comprising the step of
2 deinterleaving said combined signal if said combined signal was interleaved for transmission.

1 9. The method according to claim 2, wherein said decoding step further
2 comprises the steps of:

3 demodulating said multicarrier received signal;

4 combining said demodulated multicarrier signal using a maximum ratio
5 combiner; and

6 Viterbi decoding said combined signal.

1 10. The method according to claim 9, further comprising the step of deinterleaving
2 said combined signal if said combined signal was interleaved for transmission.

1 11. The method according to claim 7, wherein said demodulating step is
2 performed concurrently for all signals of said multicarrier signal.

1 12. The method according to claim 9, wherein said demodulating step is
2 performed concurrently for all signals of said multicarrier signal.

1 13. The method according to claim 2, wherein said first generating step is
2 performed using $\sum_{l=1}^{M_1} \mathbf{b}_l^T \tilde{\mathbf{H}}_{m,n+1-l} - \hat{\mathbf{H}}_{m,n} = 0$.

1 14. The method according to claim 2, wherein said second generating step is
2 performed using $\sum_{l=1}^{M_1} \mathbf{b}_l^T \tilde{\mathbf{H}}_{m,n+1-l} - \hat{\mathbf{H}}_{m,n+1} = 0$.

1 15. The method according to claim 1, wherein Fast Fourier transformations are
2 applied to each carrier of said multicarrier signal.

1 16. A method for estimating channel characteristics in a multicarrier transmission
2 system comprising the steps of:

3 receiving a multicarrier signal;

4 applying Fast Fourier transformations to carriers of said multicarrier signal;

5 estimating channel characteristics of a multicarrier channel over which said
6 multicarrier signal was transmitted using iterative backward processing, wherein said
7 iterative backward processing further comprises the steps of;

8 determining if a block in a frame in the received signal is correct;

9 tentatively decoding said block of said received signal;

10 calculating a tentative reference signal based on a previous training block;

11 generating a tentative estimation of channel characteristics using said tentative
12 reference signal;

13 decoding said block of said received signal;

14 calculating a reference signal based on said received block;

15 generating an estimation of channel characteristics using said reference signal;

16 decrementing the block number;

17 determining if the beginning of said frame has been reached;

18 accepting a next block of received signal if said beginning of said frame has
19 not been reached;

20 iteratively performing the steps above; and
 21 decoding said transformed multicarrier signal.

1 17. The method according to claim 16, wherein said decoding steps are performed
 2 using $\hat{\mathbf{c}}_n = \arg \min_{\mathbf{c}_n} \sum_m \|\mathbf{x}_{m,n} - \hat{\mathbf{H}}_{m,n} \mathbf{c}_n\|^2$.

1 18. The method according to claim 16, wherein said calculating steps are
 2 performed using $\tilde{\mathbf{H}}_{m,n} = \arg \min_{\mathbf{H}_{m,n}} \sum_m \|\mathbf{x}_{m,n} - \mathbf{H}_{m,n} \hat{\mathbf{c}}_n\|^2$.

1 19. The method according to claim 16, wherein said first generating step is
 2 performed using $\sum_{l=1}^{M_L} \mathbf{B}_l \mathbf{d}(\tilde{\mathbf{H}}_{m,n+l-1}) - \mathbf{d}(\hat{\mathbf{H}}_{m,n}) = 0$

1 20. The method according to claim 16, wherein said second generating step is
 2 performed using $\sum_{l=1}^{M_L} \mathbf{B}_l \mathbf{d}(\tilde{\mathbf{H}}_{m,n+l-1}) - \mathbf{d}(\hat{\mathbf{H}}_{m,n-1}) = 0$.

1 21. The method according to claim 16, wherein said decoding step further
 2 comprises the steps of:
 3 demodulating said multicarrier received signal;
 4 combining said demodulated multicarrier signal using a maximum ratio
 5 combiner; and
 6 Viterbi decoding said combined signal.

1 22. The method according to claim 21, further comprising the step of
2 deinterleaving said combined signal if said combined signal was interleaved for transmission.

1 23. The method according to claim 21, wherein said demodulating step is
2 performed concurrently for all signals of said multicarrier signal.

1 24. The method according to claim 21, wherein said demodulating step is
2 performed concurrently for all signals of said multicarrier signal.

1 25. The method according to claim 16, wherein said generating steps are
2 performed using $\sum_{l=1}^{M_L} \mathbf{B}_l^T \tilde{\mathbf{H}}_{m,n+l} - \hat{\mathbf{H}}_{m,n} = 0$.

1 26. The method according to claim 16, wherein Fast Fourier transformations are
2 applied to each carrier of said multicarrier signal.

1 27. A method for estimating channel characteristics in a multicarrier transmission
2 system comprising the steps of:

3 receiving a multicarrier signal;

4 applying Fast Fourier transformations to carriers of said multicarrier signal;

5 estimating channel characteristics of a multicarrier channel over which said
6 multicarrier signal was transmitted concurrently using iterative processing and iterative
7 backward processing; and

8 decoding said transformed multicarrier signal.

1 28. The method according to claim 27, wherein said iterative processing further
2 comprises the steps of:

3 determining if a block in a frame in the received signal is a training block;
4 tentatively decoding said block of said received signal;
5 calculating a tentative reference signal based on a previous training block;
6 generating a tentative estimation of channel characteristics using said tentative
7 reference signal;
8 decoding said block of said received signal;
9 calculating a reference signal based on said received block;
10 generating an estimation of channel characteristics using said reference signal;
11 incrementing the block number;
12 determining if the end of said frame has been reached;
13 accepting a next block of received signal if said end of said frame has not
14 been reached; and
15 iteratively performing the steps above.

1 29. The method according to claim 27, wherein said interactive backward
2 processing comprises the steps of:

3 determining if a block in a frame in the received signal is correct;
4 tentatively decoding said block of said received signal;
5 calculating a tentative reference signal based on a previous training block;
6 generating a tentative estimation of channel characteristics using said tentative
7 reference signal;

8 decoding said block of said received signal;
 9 calculating a reference signal based on said received block;
 10 generating an estimation of channel characteristics using said reference signal;
 11 decrementing the block number;
 12 determining if the beginning of said frame has been reached;
 13 accepting a next block of received signal if said beginning of said frame has
 14 not been reached; and
 15 iteratively performing the steps above.

1 30. The method according to claim 27, wherein said decoding step further
 2 comprises the steps of:

3 demodulating said multicarrier received signal;
 4 combining said demodulated multicarrier signal using a maximum ratio
 5 combiner; and
 6 Viterbi decoding said combined signal;

1 31. The method according to claim 30, further comprising the step of
 2 deinterleaving said combined signal if said combined signal was interleaved for transmission.

1 32. The method according to claim 30, wherein said demodulating step is
 2 performed using QPSK techniques.

1 33. The method according to claim 7, wherein said demodulating step is
 2 performed using QPSK techniques.

1 34. The method according to claim 9, wherein said demodulating step is
2 performed using QPSK techniques.

1 35. The method according to claim 20, wherein said demodulating step is
2 performed using QPSK techniques.

1 36. The method according to claim 27, wherein Fast Fourier transformations are
2 applied to each carrier of said multicarrier signal.